

TEMPERATURE, HYDROLOGY AND OCEAN REDOX DYNAMICS OFF LOWER CRETACEOUS EASTERN ANTARCTICA (ODP 692, WEDDELL SEA)

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On the continental slope off East Antarctica off Dronning Maud Land (Weddell Sea) Ocean Drilling Program (ODP) site 692 recovered 40 m of organic-rich Lower Cretaceous (Valanginian-Hauterivian) black shales from a paleolatitude of 70°S. Deposition occurred in the isolated and restricted Weddell Basin (WB) at a paleowater depth of about 500 m. During the Early Cretaceous, the extent, persistence and dynamics of anoxia and carbon burial in the emerging Southern Ocean are not well constrained, especially not potential links between orbital forcing on carbon cycling, temperature and continental paleohydrology.

Earlier work has demonstrated overall high OC burial (TOC av. 8.6 %) of primarily thermally immature Type II kerogen (T_{max} 413°C, HI <500); this preservation associated with abundance of framboidal pyrite indicates the presence of anoxic bottom waters in the basin, which have been associated with enhanced primary productivity coupled to reduced ocean circulation (Mutterlose & Wise, 1990, Barker et al., 1988). Based on a revised biostratigraphy, we present new high-resolution geochemical proxy records of carbon burial, ocean redox, and environmental variability, covering orbital time scale resolution of the Valanginian-Hauterivian interval.

Initial bulk geochemical proxy records (e.g. TOC >5 up to 10%, TS >1 up to 5%) and lithostatigraphy indicate stationary anoxic but not sulfidic conditions during the Valanginian-Early Hauterivian time period. Starting from the late Hauterivian, bulk geochemical and inorganic geochemistry indicate a more dynamic depositional setting with multiple multi-directional swings in TOC (>1 up to 20%) and redox indicators (e.g., Vn/Al 7-105, Mo/Al <1-6), superimposed on the long-term anoxic trend, likely related to short (orbital scale) perturbations. To shed further light on the nature and impacts of these short-term perturbations in carbon burial and redox, we present first molecular analyses of lipid biomarkers, in order to reconstruct OM source, paleotemperature (GDGT-based SST, MBT) and continental hydrology (compound-specific hydrogen isotopes).

With a targeted average maximum resolution of around 25 ky for the bulk geochemical records, this new record will enable to assess if and how Antarctica responded to orbitally-driven climate cycles during the Valanginian-Hauterivian, and how these external forces impacted on fluctuations in temperature and ocean redox in the high southern polar regions.

References

Mutterlose, J., & Wise Jr, S. W. (1986). Lower Cretaceous nannofossil biostratigraphy of ODP Leg 113 Holes 692b and 693a, continental slope off east Antarctica, Weddell Sea. In *Proceedings of the Ocean Drilling Program: Scientific results* (Vol. 113, p. 325): College Station, TX (Ocean Drilling Program).

Barker, P. R., Kennett, J. P., et al., 1988. *Proceedings of the Ocean Drilling Program: Initial results*, 113: College Station, TX (Ocean Drilling Program).